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ABSTRACT

This monograph focuses on the design of accessible industrial education facilities for individuals with physical disabilities. In chapter 1 accessibility is defined, and three significant pieces of federal legislation regarding the equality of educational opportunities for special needs populations are discussed. The role of industrial education in mainstreaming students with physical handicaps is also addressed. A modification system for improving the interface between the learner and the built environment is then described in detail. Each of four sections in the system--system inputs, process of making safe modifications, system outputs, and evaluation--and their major elements are considered. Chapter 2 focuses on facility modifications to consider when improving the interface. The following kinds of modifications are discussed: maneuvering in space, approaching machines and equipment, obtaining tools and supplies, transporting tools and supplies, manipulating controls, and facilitating communication. (YLB)

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ED224988

A Professional Monograph

MAKING INDUSTRIAL EDUCATION FACILITIES ACCESSIBLE TO THE PHYSICALLY DISABLED

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CHAPTER 1

A BASIS FOR MAKING FACILITIES ACCESSIBLE

Many educators recognize that curriculum and facilities are interrelated and must be mutually supportive of each other. There has always been a close relationship between curriculum and facilities in industrial education. Because of this, a considerable amount of data and information has been accumulated regarding facility design.

Recently, however, educators have been made increasingly aware of the need to make industrial education facilities accessible to *all* students. To many, the idea of accessible industrial education facilities poses several questions: What is an accessible facility? Why must industrial education facilities be accessible? For whom do we make the facilities accessible? How do we make an existing or new facility accessible?

The purpose and focus of this monograph is to answer these and similar questions regarding accessible industrial education facilities for individuals with physical disabilities.

Accessibility: What Is It?

Accessibility is defined as "the combination of various elements of the built environment which allows entrance to, egress from, and use of buildings and facilities by the public" (Jones, 1978, p. 1). In education, the term *program accessibility* is often used.

Program accessibility has two main elements: The first element is an accessible built environment. The built environment includes all buildings, areas, machines, and/or items where humans must interface or function with items designed and built by other humans. Many problems in program accessibility can be traced to the fact that much of the built environment is, for market reasons, designed for individuals of "average" size or ability. When individuals with physical limitations beyond the average or norm interface with these built objects, problems of accessibility (barriers) often occur. These physical barriers can be easily recognized; and, given time and proper resources, solutions can usually be identified.

The second element of program accessibility involves an institution's efforts to mainstream students with special needs into programs with "normal" students. Problems related to mainstreaming are basically systematic and social in nature (Paul, Turnbull, & Cruickshank, 1977).

Systematic problems will often result in changes to school policies or structures. These changes, however, will have little effect if the social and mental attitudes of all individuals involved are not at least sympathetic to the requirements of mainstreaming. Once recognized, the systematic and legal aspects of mainstreaming are often easily overcome. Mental and social attitudes of the "normal" individuals involved in mainstreaming will be more difficult to identify and, if negative, the most difficult to overcome.

Philosophical Position

Several significant moral, economic, and legal issues surround program accessibility and the education of individuals with special needs. Recent legislation mandates the equality of educational opportunity for that large segment of the school population with special needs. Although numerous state and federal laws document the growing urgency of this problem, the following discussion will only focus on three of the most significant pieces of federal legislation.

The first significant piece of federal legislation to be considered is the Education for All Handicapped Children Act, PL 94-142 (1975). This act has been hailed as the Bill of Rights for handicapped individuals. Section 601(c) of the act describes the purpose and intent of the act:

> It is the purpose of this Act to assure that all handicapped children have available to them, within the time periods specified . . . a free appropriate public education which emphasizes special education and related services designed to meet their unique needs, to assure that the rights of handicapped children and their parents or guardians are protected, to assist state and localities to provide for the education of all handicapped children, and to assess and assure the effeciveness of efforts to educate handicapped children. (Brolin & Kokaska, 1979, p. 23)

Although the law was passed in 1975, it did not become effective until October 1, 1977, and final implementation was delayed until September 1, 1980. In this act, all individuals between the ages of 3 and 21 with special needs are eligible for special and related educational services. However, the law does allow exception to this when state law or court ruling excludes individuals between the ages of 3 and 5, and 18 and 21.

The next important pieces of federal legislation to be considered are the education amendments of 1976. These amendments contain the provisions that affect the vocational training of handicapped individuals. In particular, PL 94-482 builds on and extends the Vocational Education Act of 1963 (PL 88-210) and the Vocational Education Amendments of 1968 (PL 90-576). The new legislation of 1976 continued the amendments of 1968, amendments requiring the state to spend at least 10% of their basic federal/state grant-in-aid funds for vocational programs to meet the needs of handicapped individuals, and added the provision that state and local funds could be used to match a portion of the set-aside monies (Brolin & Kokaska, 1979).

The third piece of federal legislation is section 504 of the Rehabilitation Act Amendments of 1973 (PL 92-112). This legislation reinforces all other legislation related to the handicapped. It stipulates that "no otherwise qualified handicapped individual . . . shall solely by reason of his or her handicap, be excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance" (Brolin & Kokaska, 1979, p. 30). The impact of section 504 on program accessibility, public education, and architectural changes is extensive. It reaffirms the right of handicapped individuals to a free and appropriate education. Program accessibility is mandated as a fundamental principle of the civil rights of handicapped

individuals. Program modifications in public education include (a) changes in class schedules, (b) alternative activities for meeting program goals or objectives, (c) the integration of the handicapped student into the mainstream of the educational environment, and (d) the use of technological devices to enable those with severe handicaps to participate.

The aforementioned legislation will have an ever-increasing impact on the lives of both "normal" and handicapped individuals. Economically, it could change the social structure of a minor element in society. There are now more than 8 million handicapped children in the United States. By providing appropriate educational opportunities, including vocational training, the majority of these individuals can become self-reliant, self-supporting adults. The *opportunity* to develop to their full potential is their right as members of society. As educators, it is our moral responsibility to assist them in this goal.

The Role of Industrial Education in Mainstreaming

To understand fully the role of industrial education in mainstreaming, a common knowledge and understanding of the ideas and terms used will enhance further communication. Terms and ideas that require additional clarification include *industrial education, mainstreaming,* and *special-needs student.*

Industrial education is a generic term used to designate or describe various kinds of educational programs of an industrial nature. These programs include vocational education, industrial arts, industrial technology, technical education, and apprenticeship training in both public and private schools. Students range in age from preschool to adult. Program goals include a wide range of industrial-related activities and experiences that can be general education, vocational, and/or avocational in nature (Good, 1959).

Like industrial education, *mainstreaming* is a term created by educators. This term does not appear in any of the legislation described earlier. It is used to give meaning or continuity to the many characteristics or facets of the legislation.

The National Advisory Council on Education Professions Development has developed a definition or description of mainstreaming that encompasses all of the major elements of the federal legislation. They concluded that

> mainstreaming is the conscientious effort to place handicapped children into the least restrictive educational setting which is appropriate to their needs. The primary objective of this process is to provide children with the most apprpriate and effective educational experiences which will enable them to become self-reliant adults. Within this objective, it is thought preferable to educate children the least distance away from the mainstream of society. Hence, there is a heavy emphasis on movement into the regular classroom whenever possible. (Dahl, Appleby, & Cipe, 1978, p. 7)

Through an analysis of the key elements included in the above definition, a list of basic themes relative to mainstreaming can be derived.

> Mainstreaming *is:*
>
> (1) providing the most appropriate and effective education for each individual in the least restrictive environment;

(2) looking at and for the individual's abilities and needs instead of his/her disabilities or clinical diagnostic labels;
(3) developing a system for and creating alternatives that will help general educators serve individuals with special needs in the regular classroom: and
(4) combining the skills and resources of general, technical, and special educators to provide an equal educational opportunity to all individuals.

Mainstreaming *is not:*

(1) the indiscriminate return of all special needs students back into regular classes;
(2) the elimination of special classes or support services that have been specifically designed for the special needs learner;
(3) ignoring the need of some individuals for programs that are more specialized than can be provided in a regular class or program; or
(4) less costly than serving special needs learners in self-contained classrooms. (Paul et al., 1977, pp. vii-viii)

Until now, the term *special needs* has been used interchangeably with the term *handicapped*. These are key words in the legislation and many of the other definitions sighted thus far. But exactly what is a special-needs learner? By definition, *special needs* includes or is used to describe individuals who are handicapped and/or disadvantaged in some manner that inhibits an individual's progress in school (American Vocational Association Industrial Arts Division, 1979).

Disadvantaged learners, unless accompanied by a physical limitation, seldom have problems of accessibility with the built environment. These individuals are potentially identified as disadvantaged because academic, economic, cultural, social, or emotional problems prevent them from succeeding in the regular classroom. Thus, they require special assistance.

The *handicapped* also require special assistance. This special assistance or service may be related to problems of academic, behavioral, economic, mental, or physical limitations. (Handicapping conditions and characteristics will be addressed in more detail in the following section.) Persons with these limitations are often identified as mentally retarded, learning disabled, emotionally disturbed, visually impaired, hearing impaired, speech impaired, physically handicapped, having problems of coordination, health impaired, having problems of aging, and multihandicapped.

As you can see, the kinds of disadvantaged and handicapped conditions are extensive. But as educators, we must remember that these individuals all have more similarities than dissimilarities and that their education should be appropriate, focusing on individual strengths rather than individual weaknesses. The optimal goal is being an individual that is self-reliant, self-sufficient, and capable of contributing positively to society. See Figure 1, page 7.

Industrial education must play a major role in helping disadvantaged and handicapped individuals reach these goals. The goals and career expectations of the disadvantaged and handicapped are as wide and diversified as their abilities and of the population we classify as "normal." A list of famous and not-so-famous disadvantaged and handicapped individuals would be endless, and

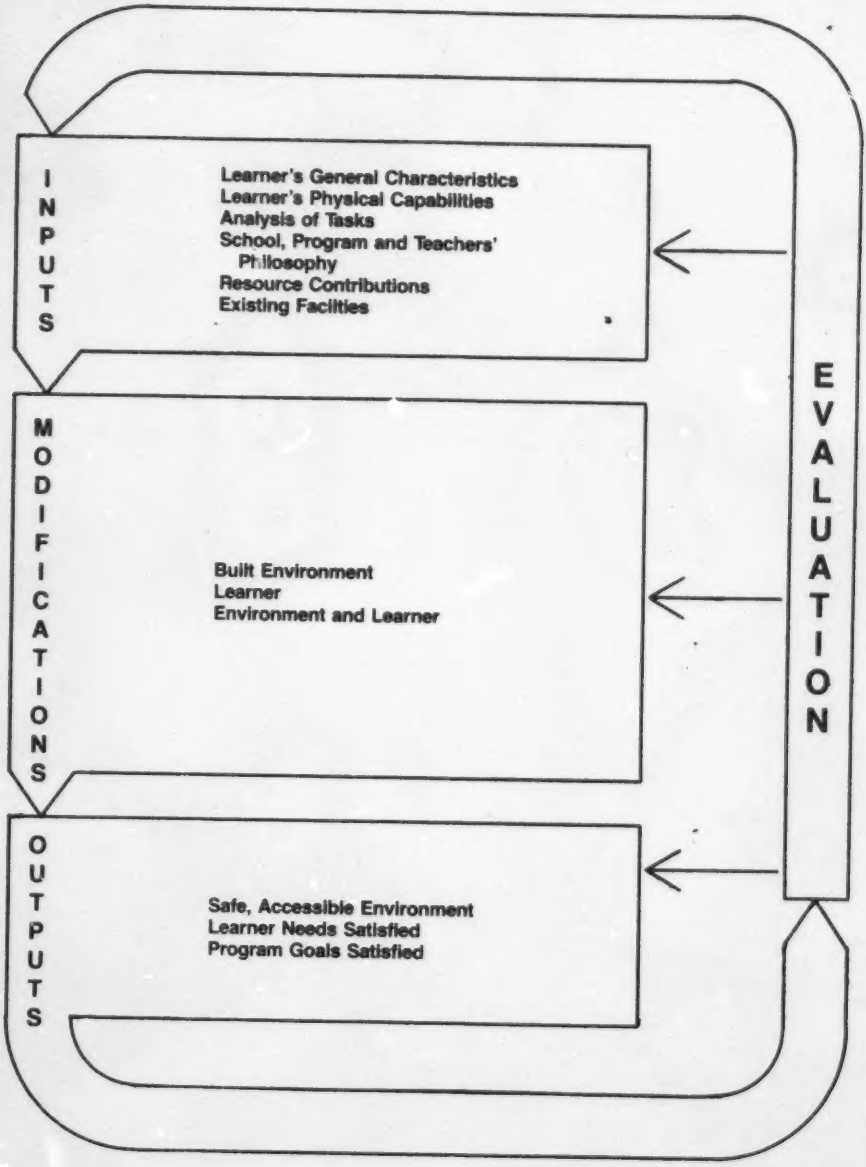


Figure 1 — System For Improving the Interface Between Learner and Environment

identified careers would range from sheltered workshop personnel to several presidents of these United States.

Ability and *potential* are the key terms in any educational endeavor. By integrating or mainstreaming special-needs learners into industrial education, they too can receive the benefits of the knowledge gained by studying the social, trade, and economic impact that industry and technology have on society. This task is not small. For learners to be successful, it will take the combined efforts of all educators, general and vocational.

As part of general education, industrial arts must continue to improve its ability to provide the learner with the opportunity to develop an understanding of the concepts and skills related to living in an industrial society. The industrial arts teacher should work closely with teachers from special education and other school personnel to ensure a complete, well-rounded program. This program should encourage learners to participate in experiences that will help them develop the necessary life skills to function in society. These experiences should also introduce and reinforce the concepts and skills that will further the development of the learner's career awareness, patterns, and expectations (American Vocational Association Industrial Arts Division, 1979).

After a successful experience in industrial arts, the special-needs learner may select, if appropriate, one of the many available vocational, technical, and apprenticeship training programs. These programs are capable of providing the special-needs learner with the knowledge, skill, and attitudes necessary to obtain entry-level positions in selected careers or vocations.

Whether the planned activities are general education, vocational, or avocational in nature, the teacher needs insight into (a) the special-needs learner's self perception; (b) knowledge and understanding of the special-needs learner's characteristics and abilities; (c) a system that will allow and encourage teacher, family, and administration cooperation to create learning experiences that are appropriate and meet the needs of the individual learner; and (d) an evaluation system that will monitor the progress and accomplishments of the special-needs learner (American Vocational Association Industrial Arts Division, 1979).

The Physically Handicapped

Physical handicaps differ in form and degree. In form they may be the result of sensory impairments (e.g., vision or hearing) or motor impairments (e.g., cerebral palsy). The degree to which a disability is handicapping depends on the individual circumstances and many other variables. The major variable is the extent or degree to which a particular disability hinders the person's ability to function normally in the built environment or society. (Gardner & Warren, 1978)

Disabilities are the result of differences, impairments, or injury to or during the developmental process. Observe two persons — one extremely thin and the other extremely fat. Their differences will cause them both problems. These problems may not be the result of impairment or injury to the body, but the result of the person's differing from the norm for which the built environment was designed. "In general, one might say that other things being equal (which they often are

not), the greater the difference, the greater the disability" (Gardner & Warren, 1978, p. 17). The ability to overcome a disability in part depends on the degree to which the learner is different from the norm or general public and the individual's ability to adapt or adjust.

"Some differences are due to an injury or an impairment. Some may be due to *deficits* related to developmental *defects*, others may be a consequence of *impaired* functioning of the central nervous system, the glandular system, or some other part of the body" (Gardner & Warren, 1978, p. 17). Impairments and deficits occur when an individual has what seems to be a normal intact organism that is not functioning up to normal standards. For example, a person's ears have no unusual configuration or outwardly visible indication that they are not formed and working correctly; however, behavior patterns indicate and later testing confirms that the individual's hearing is impaired. Other invisible impairments include Addison's disease, diabetes, ulcers, epilepsy, and hemophilia.

Deficits also include impairments that are outwardly visible. These may include congenital malformations, such as imperfectly developed arms, hands, legs, and head (Gardner & Warren, 1978).

Injuries can result in any one or more parts of the body becoming temporarily or permanently dysfunctional. The injuries can result in a difference, deficit, or defect. For example, a punctured eardrum may cause impaired hearing. This is considered to be a hearing deficit because the impairment has no readily visible signs that would indicate a hearing loss. A badly mashed finger or hand may have to be amputated. The amputation results in a defect because the body now lacks completeness or does not have all of its normal parts. Although injuries are common after birth, injuries can occur prenatally, causing congenital defects. After birth, such defects may become deficits or impairments (Gardner & Warren, 1978).

Table 1 identifies several sensory, motor, cognitive, and psycho-social impairments. Also shown are some of the common characteristics and needs of each impairment. These characteristics and needs may be helpful in developing an understanding of a particular special-needs learner.

When considering the needs of individuals with physical handicaps, there are several common factors to be considered or developed: attitude toward work, interpersonal and social skills, a strong drive for independence, and an ability to cope with a barrier-laden environment. Whether the identified needs or characteristics are the result of injuries, impairments, deficits, or difference, these characteristics identify the manner an individual can differ from the norm. These differences can lead to disabilities, "some of which may be handicapping" (Gardner & Warren, 1978, p. 18).

A System for Improving the Interface Between the Learner and the Built Environment

The primary purpose for improving the interface between the learner and the built environment is to improve the learner's ability to succeed in school. Other reasons include improved safety, modified attitudes toward work, increased

Table 1
Special-Needs — Learner Characteristics and Needs

HANDICAP	CHARACTERISTIC	SPECIAL NEED
Hearing impairment	Degree of impairment: **slight** — loss of 20 decibles or fewer **mild** — loss of 20-40 decibles **moderate** — loss of 40-60 decibles **severe** — loss of 60-80 decibles **deaf** — loss of greater than 80 decibles Includes all persons with a loss sufficient to affect their function in public areas, either permanent or fluctuating	Modification and/or adaption of individual or environment Use of alternative methods of communication Special assistance in learning and interpreting Social and instructional systems Reduction of overall noise levels
Speech impairment	Difficulty of pronunciation and/or impairment of speech patterns Stuttering, impaired articulation Problems with vowels and consonant sounds	Development and use of other communication skills or systems Patience and understanding More time, speech therapy
Health impairment	Chronic illness (e.g., heart problems, diabetes, allergies, poor stamina, and alertness), limited strength, vitality, or alertness	Potential environmental problems recognized Shorter units of activity Understanding of problems Frequent rest periods Close working relationship between student, teacher, parents, and school health officials
Physical impairment	Can usually be classified as: neurological, spinal cord injury, or amputation Nonambulatory: physical impairments that confine persons to wheelchair mobility Semiambulatory: physical impairments that cause persons to walk with difficulty Some persons may have difficulty with paralysis, weakness, poor motor control, abnormal movement, physical development (growth/size), fractures, amputation No relationship between physical development and intelligence	Modification and/or adaptation of individual or environment Accessible built environment: flooring, ramps, handrails, work surfaces, tools, machines, etc. Task analysis, more time, peer tutor If appropriate, close working relationship with special needs teacher Respect, honesty, and understanding Recognize the handicap and limitations it causes and adapt the learning environment Student should be given the right to succeed or fail

Table 1 (continued)

HANDICAP	CHARACTERISTIC	SPECIAL NEED
Aging	Impairments caused by the aging process	Understanding and services appropriate to the characteristics demonstrated
Multihandicapped	Combination of two or more of the above	Combination of needs appropriate to the characteristics demon strated
Mentally impaired	IQ of 50-80 — mildly handicapped IQ of 40-50 — moderately handicapped IQ of 25-39 — severely handicapped IQ of below 25 — profcundly handicapped Moderately and mildly may develop academic skills to a level equivalent to sixth grade Manual dexterity generally exceeds mental performance	More time to learn More individual assistance Activities stressing learning by doing An environment stressing positive development and reinforcement Task analysis of performance activities
Learning disabled	Can be either auditory, visual, or motor in origin Problems of understanding or using written communication Easily distracted Poor self-concept	Organizational skills Individual help and positive reinforcement Repeated and simplified directions Understanding Alternative methods of communication
Emotionally disturbed	Frequently have an abnormal concern for health Exhibits immature and inappropriate behavior Demonstrates poor peer relationships Shows a lack of self-confidence Has an obsession with an idea or interest Demonstrates insensitivity to individual differences Exhibits anger and hostility when instructions are not clearly understood	Reinforce constructive and desirable actions Calm, orderly environment and consistent discipline Removal of distracting elements in the environment (outside noises, odors, etc.) Expectations need to be clear
Visual impairment	Impaired color vision Restricted field of vision Reduced visual acuity	May need assistance with mobility Enlarged print and raised images Equipment modification-accessible environment Increased use of verbal insructions Well-lighted work areas Inclusion of learner in activity planning Modification and/or adaptation of learner or environment

independent functioning, enhanced mobility and expanded task performance skills.

For an individual or item in the built environment to *interface* successfully, they must have a common point or method where they can meet and act upon or communicate with one another (*Webster's Seventh New Collegiate Dictionary* 1971). For many disabled or handicapped persons, this ability to interface with identified items in the built environment is not possible because of differences in physical characteristics or abilities. They are not compatible with the built environment. To improve this compatibility, modification can be made to either the individual, the identified item in the built environment, or both.

When attempting to improve the interface between the learner and the built environment, it is useful to establish and use a system for governing or guiding the process. This way, fewer things are left to chance, and all persons involved will have a better understanding of the activity. A modification system for improving the accessibility of industrial education facilities for persons with physical disabilities or handicaps is shown in Figure 1. As indicated, its primary purpose or use is the improvement of the interface between the learner and an identified task. This system, however, is also useful when planning the learner's Individual Education Plan (IEP).[1]

The modification system consists of four major sectons: (a) system inputs, (b) process of making safe modifications, (c) system outputs, and (d) evaluation. Each section consists of several elements. Each element indicates a major information-gathering, modification, or evaluation task. All elements must be taken into consideration during the modification process. Although the elements making up the inputs into the system represent the first information and data gathered during the process, once the system is activated, new information and data should be constantly interjected into the system and all inputs, processes, and outputs evaluated. In this manner, the system continuously cycles, and improvements implemented.

To improve the reader's understanding of the system and the interrelationship between each of the major sectons, each section and its major elements will be described in more detail. The first major section to be described is the system inputs. The inputs into the system have six elements: (a) assessment of learner general characteristics; (b) assessment of the learner physical capabilities and limitations; (c) analysis of required tasks, (d) philosophy of the school, program, and teachers; (e) infomation contributed by identified resources; and (f) characteristics of existing facilities.

One of the important inputs into the systems for improving the interface between the learner and the built environment is an assessment of the learner's general characteristics and needs. Many assessment procedures and techniques are available to determine learner characteristics. These characteristics (see Table 1) often include problems of mental development; sight, hearing and learning deficiences; physical disabilities; emotional stability; and communications. The assessment of the degree and scope of these characteristics and the determination of the appropriate needs is important information when making curricular or

facility modifications. The industrial educator, however, often lacks the necessary knowledge and skills to select, administer, and interpret the appropriate assessment technique. When this occurs, the industrial educator must be willing and able to identify appropriate resources.

Potential resource personnel can provide significant input into the process. These include special-needs teachers, teachers of related disciplines, psychologists, counselors, specialist organizations (e.g., United Cerebral Palsy), parents, and "handicapped learners." Other significant resources include reference books or texts and federal, state, and local agencies (see Appendix A).

Before assessment occurs, identified resource personnel should be given a clear set of program goals. These goals will help determine the appropriate assessment procedures and will be imperative to the development of appropriate teaching/learning strategies, evaluation systems, and physical and social environments.

The industrial educator must use all identified resources. Each has a vital contribution to make in developing the learner's individualized education plan. The experience, knowledge, and skills gained through participation in an industrial education program will help the learner to become a self-supporting and reliant adult. The industrial educator should also inform resource personnel that many industrial education activities develop and improve special-needs basic skills, such as hand-eye coordination, stamina, visual and tactile discrimination, improved memory, and improved timing.

[1]IEP is a vital part and requirement of PL 94-142, which requires each school system to develop in writing an individual education plan for each handicapped learner and that this plan have parental approval. See page 17 for additional information.

When planning modifications to improve accessibility, it is essential that the learner's physical capabilities and limitations be assessed. The success of these modifications will, in many instances, depend on the teacher's understanding of the scope and degree of these limitations and capabilities. This can be effectively accomplished by analyzing the individual's interface with the built environment. (This should be carried out by the industrial educator and appropriate resource personnel.) The following six elements can be used to guide the analysis process of the interface between the learner and the task being performed:

1. The distances through which an individual must transport him/herself (body or limbs) or material (objects); the distances (space) through which an individual must transport him/herself or material.
2. The amount of force the individual needs to transport him/herself or material during the performance of the task.
3. The time frame in which the individual needs to perform an identified task.
4. The type and quality of body movements that are capable of being used to perform an identified task.
5. The type and quality of human senses used or required to perform an identified task.
6. The type and quality of the mental functions necessary to plan and/or perform an identified task.

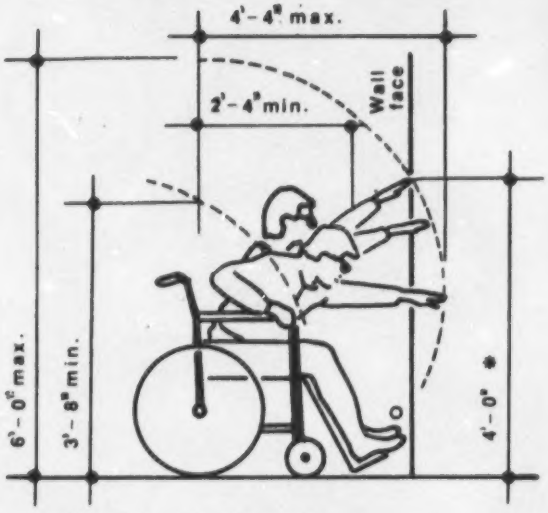
For example, the goal of a student confined to a wheelchair is to become an industral education teacher. An analysis of the material conversion and transportation processes involved in part of the curriculum (woods processing) reveals potential problems in leg room, reach, and equipment heights. These problems exist because most of the equipment was designed for use in a standing position. Until the tasks involved are analyzed, however, three important questions cannot be answered: (a) Can the tasks be successfully completed without modifications? (b) What changes will be required to assist the handicapped person perform the tasks? and (c) If the tasks cannot be performed successfully, what other learning strategy can be substituted that will allow the student to complete the curricular goals and objectives?

In the above example, the student finds it necessary to operate and perform normal maintenance on a jointer. The operation of the jointer requires the operator to be able to (a) reach and manipulate all controls while providing sufficient downward pressure and (b) transport the entire length of the material across the cutting elements. Using the six elements — distance, force, time, body movement, senses, and mental function to analyze the tasks involved — potential problems are identified in this particular case, in all elements except mental function.

An analysis of the interface between this particular learner and the jointer reveals two major factors contributing to problems of jointer accessibility: (a) the physical dimensions of the jointer and (b) the type and location of various controls. For this individual and many similar special needs persons, these problems may manifest themselves as:

1. insufficient clearnace under the work surface of the jointer for the individual's feet (distances-space).
2. insufficient reach of the operator to transport large material through the process (distances, body movement, and time).
3. limited downward and forward pressure because of the seated position (force and body movement).
4. improper table height (distances-space).
5. improper control locations for quick and easy access (distances and body movement).
6. improper signage on the machine and its controls for many special-needs persons (distances and human senses).
7. lack of proper or normal perspective (because the person is performing the task at a lower level or height than usual (distances and senses).
8. improper floor covering the processing area (force).
9. insufficient clearance around the machine to allow for the necessary movement of the operator (distances-space).

Following the analysis and the identification of several potential problems in this example, the industrial educator worked in conjunction with the resource personnel and the handicapped individual to make several recommendations to improve jointer accessibility (see Figures 2 and 3). It should be noted that as in

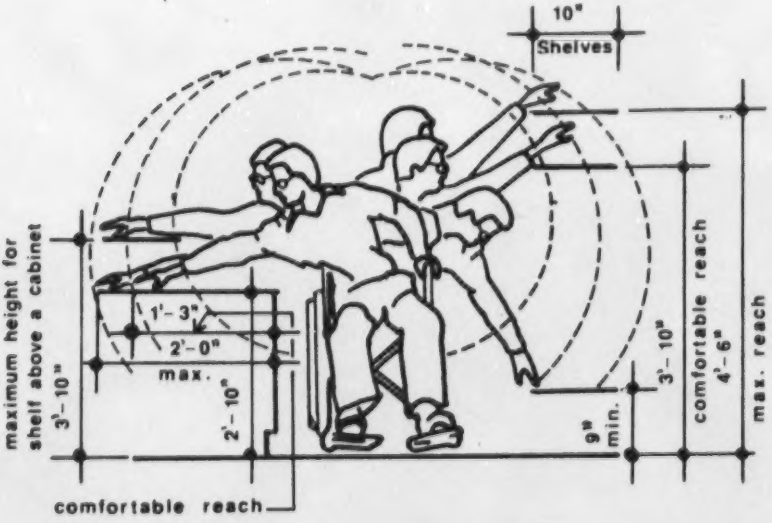


Lack of trunk balance may reduce an individual's ability to lean forward and thus restricting reach.

*Highest point of any device when access is by forward reach only.

*Feet hitting wall prevent maximum forward reach from being achieved.

Ranges of forward reach from a wheelchair. (Jones, 1978, p. 16)



Ranges of side reach from a wheelchair. Shelves and work surfaces indicated to illustrate furniture constraints. (Jones, 1978, p. 17)

Figure 2 — Jointer Accessibility

Jointer Accessibility Recommendations

The following recommendations are offered to make the jointer accessible to a wider range of individuals:

(1) jointer table or working heights
   a. 30" (76cm) - 34" (86.5cm)

(2) clearance under the jointer for the feet of semi-ambulatory individuals:
   a. 18" (46cm) depth
   b. 18" (46cm) available height
   c. 32" (81cm) width

(3) auxiliary equipment, dust collection system controls, and attachment storage should be within easy reach of the operator:
   a. 15" (38cm) - 24" (51cm) of the processing surface
   b. 20" (51cm) - 4'6" (1237cm) from the floor

(4) all machine controls should be
   a. within 18" (46cm) radius reach of the operator
   b. between 10" (51cm) and 4'6" (1237cm) from the floor

(5) the clearance area around the machine should include:
   a. a clear floor area of 4'x7" min. in the area normally used for machine operation
   b. a 3'-4' aisle around the machine for maintenance and walk aisle

(6) floor coverings around the machine should be non-slip and fulfill the standards as listed in the floor covering section

(7) all signage and warning signals should be accessible

(8) the ability to transport various lengths of material across the processing element of the jointer will depend upon the capabilities of the operator. However, for some individuals it is recommended that these lengths not exceed 24". This dimension being the maximum comfortable reach while in a seated position.

See Figure 2 for illustrations.

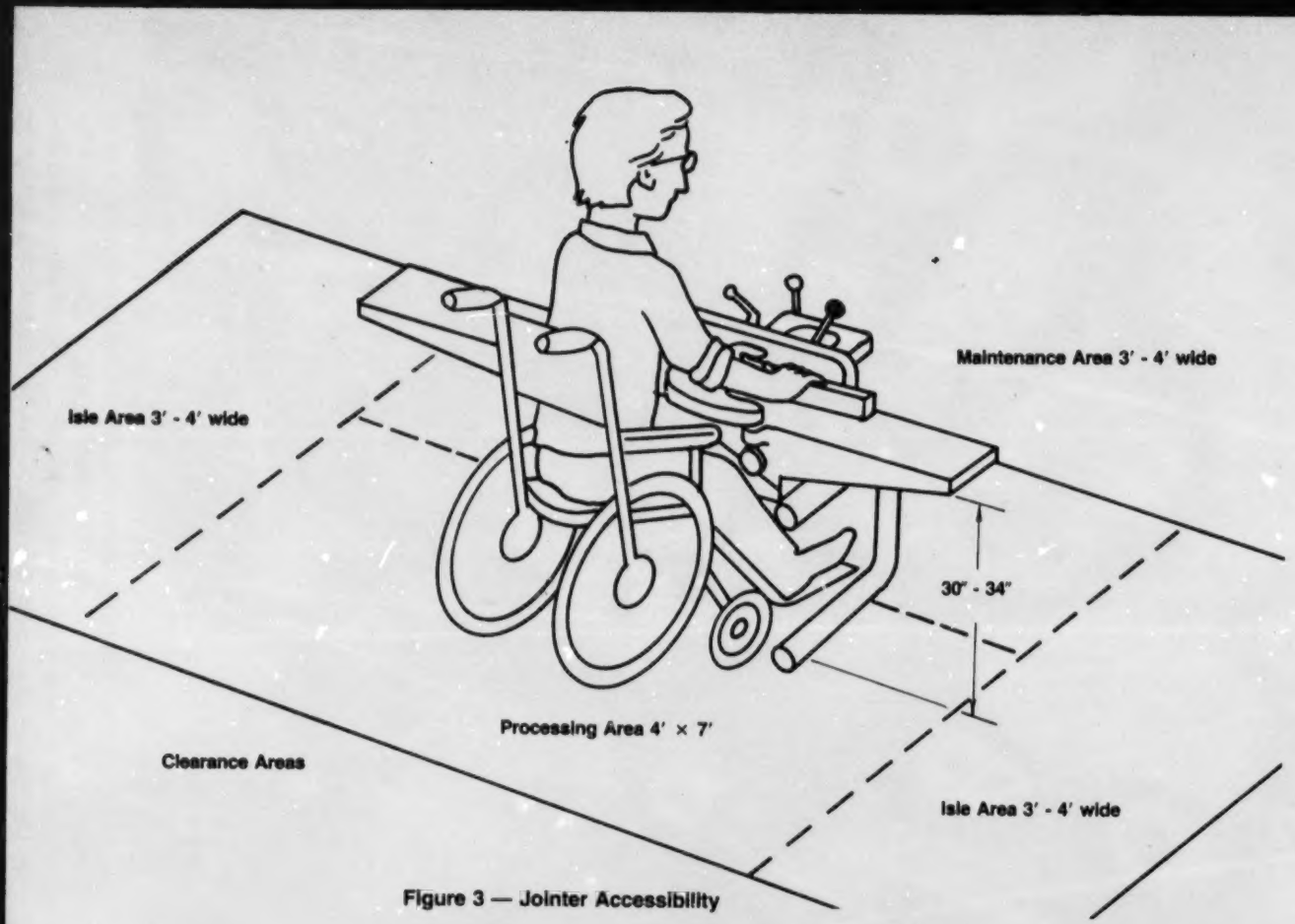


Figure 3 — Jointer Accessibility

many other instances, suggested modifications also improved the accessibility of the jointer to the "normal" students as well.

Two elements of the modification system have been explained; however, without the third input into the system — identification and analysis of tasks required — the assessment of the learner's general and physical characteristics would be futile if the analysis did not reflect or take into consideration the task to be performed. The identification and analysis of the required learner tasks in any industrial education program will have several elements. These elements include (a) program and course goals; (b) course, unit, and lesson objectives; (c) learner objectives; (d) the IEP, (e) potential teacher/learner strategies; and (f) task analysis.

Program and course goals should not be changed or altered when modifying curriculum or facilities to meet the needs of the handicapped learner. To provide equal opportunity and responsibility for the handicapped learner, the program and course goals must be the same as those for "normal" learners. Therefore, to meet the unique needs of the handicapped learner, only the teaching/learning strategies, evaluation systems, and/or the physical and social environment should be changed to match or interface with the learner's potential abilities and objectives.

The IEP is a vital element in the task identification process. To fulfill legal requirements, an IEP must be developed for each learner that is identified as handicapped. The IEP is developed by a team of resource personnel. This team will often include the school administrator, resource personnel specializing in assessment, special educators, classroom teachers, parents, and when appropriate, the handicapped learner.

The IEP contains several elements concerning learner characteristics and needs and how the plan is to be implemented and evaluated. Some of the common elements include (a) learner assessment, including mental, social, and physical performance levels; (b) program information, including program placement, rationale, extent to which student is to be mainstreamed, special services required, necessary physical education or therapy programs needed, and extent to which industrial education programs are to be used; (c) implementation information, including preferred learning style, student needs, strengths and talents, special instructional materials needed, and names of persons responsible for program implementation; (d) staff information including meeting dates, sign-off procedures and dates for reevaluation; (e) program, including goals, long- and short-term objectives, objective criteria and evaluation systems and procedures, and schedules of major events in the IEP (American Vocational Association Industrial Arts Division, 1979).

Industrial educators should participate in the IEP development of every handicapped learner in their programs. The industrial educator will find this a rewarding experience and will discover vital first-hand information concerning the students' needs. Service on the IEP committee will also help to establish the necessary lines of communication with the resource personnel. This is imperative if the industrial educator encounters difficulty in the preparation of appropriate

objectives, teaching/learning strategies, evaluation systems, and/or the physical and social environments for the identified learner.

In a preceding section, an example was used concerning a handicapped student whose goal was to become an industrial educator. This student was successful in achieving this goal, partially because the philosophy of the school, program, and teachers was conducive and supportive of the endeavor. If the philosophical positions had been otherwise, the student probably would not have been successful. These philosophical beliefs, concepts, and attitudes of the individuals or groups involved in the modification process should be taken into consideration and, if necessary, analyzed during the process. Poor attitudes and opposing beliefs can be more detrimental to the modification process than the individual's disabilities or limitations are handicapping. Again, it may be necessary to use appropriate personnel and resources in the modification of attitudes and beliefs of these individuals.

One of the final inputs into the modification system is the characteristics of existing facilities. As with many of the other inputs, there is a series of individual elements and a total picture that must be taken into consideration during the modification process. The individual elements that make up this total facility picture include the tools, machines, laboratory furniture, materials, and services found in the facility.

Although many industrial educators would be quick to point out that no two industrial education facilities are alike, there are common characteristics each should possess after the process of making safe modifications. These common characteristics include (a) distances and spaces that permit all individuals to maneuver conveniently throughout a laboratory; (b) distances and spaces that allow all individuals to approach, assume a proper working position, and use all tools, machines, furniture, and services; (c) tools and supplies stored in suitable locations so they are relatively easy to obtain; (d) areas and/or devices that make it safe and comfortable to transport tools, supplies, and so forth; (e) distances, spaces, and devices that allow the operator to manipulate controls on machines and tools, and (f) areas and/or devices that encourage and improve the effectiveness of communication between individuals and the exchange of information between the built environment and the learner. These characteristics and suggested modifications will be dealt with in greater detail in Chapter 2.

The second section of the modification system is the process of making safe modifications. The process of improving the interface between the learner and the built environment by making safe modifications has three elements: (a) modification of the built environment, (b) modification of the learner, and (c) a combination leading to modification of the learner and built environment.

Although all three elements must be taken into consideration during the process, the industrial educator's training and skills will probably lend themselves to making more successful modifications to the built environment than in the other two elements. As indicated, the standards and modifications that will improve the handicapped learner's ability to maneuver around, approach, obtain, transport, manipulate, and communicate with the items in the built

environment will be discussed in Chapter 2. These modifications, when based on valid inputs, will result in an output of a safer and more accessible learning environment for the handicapped learner.

The third section, system outputs, also has three elements or purposes: (a) a safe and accessible environment, (b) the needs of the learner appropriately satisfied, and (c) the goals of program appropriately satisfied. Through facility modification and appropriate teacher/learner strategies, the handicapped learner will be provided access to an education based on an equal opportunity and responsibility to learn.

Evaluation is the final section in the system for improving the interface. Each section of the system inputs, process, outputs, and evaluation itself must be evaluated. The addition of evaluation to the system forms what should be a continuous loop or cycling process that should never cease to function or be used to analyze and evaluate the problems of facility accessibility.

When analyzing or evaluating the problems of facility accessibility, the checklist shown in Figure 4 may prove useful when trying to visualize all the elements in the system.

As a form of self-evaluation, the industrial educator should ask four questions upon completing any modification;

1. Has the modification actually improved accessibility?
2. Will the modification hinder other learners?
3. Does the modification allow the identified learner to perform the identified task safely?
4. Have all problems of program accessibility been appropriately eliminated?

Unfortunately, except for certain architectural features, few ironclad standards can be offered regarding facility modification. The reasoning is that handicapped persons, like "normal" persons, are different in size, shape, and abilities. There are no two handicaps or handicapped persons that are identical. If the system for improving the interface between the built environment and the learner is used, however, vital information concerning the learner, the educational activity, and existing facilities can be derived. This data, when integrated with the information to be presented in Chapter 2, will assist teachers in making the necessary facility modifications that are appropriate for identified handicapped learners.

Figure 4 — Checklist for Improving the Interface Between the Built Environment and the Learner

A. Inputs into the system.
   1. Assessment of the learner's general characteristics and needs
      a. Available resources used
      b. Assessment techniques identified
      c. Learner characteristics and needs identified
   2. Analysis of learner physical capabilities and limitations in relation to identified task.
      a. Range of movement required by task identified
      b. Force needed to perform task identified
      c. Time frame for completion of task identified
      d. Type of body movements utilized in the performance of task identified
      e. Human senses used during task identified
      f. Mental functions required to plan and/or carry on task identified
      g. Physical capabilities and limitations identified
   3. Identify and analyze required tasks.
      a. Program and course goals identified
      b. Course objectives
      c. Learner objectives
      d. Individualized Education Plan (IEP) developed
      e. Potential teacher/learner strategies identified
      f. Task analysis performed
   4. Philosophy of teachers, program and school system stated and utilized.
   5. Information contributed by identified resources utilized.
   6. Characteristics of existing facilities.
      a. Potential interfaces between existing tools, machines, material and learner identified
      b. Potential interfaces between existing furniture and learner identified

B. Process: Making Safe Modifications.
   1. Modification of the built environment.
      a. Potential interfaces between learner and environment identified
      b. Most appropriate modification to satisfy interface requirements identified
      c. Environment modified
   2. Modification of the learner.
      a. Potential interfaces between environment and learner identified
      b. Most appropriate modification to satisfy interface requirements identified
      c. Learner modified
   3. Combination — modifications to both the learner and environment completed.

C. Output: Safe and Accessible Environment.
   1. Needs of learner appropriately satisfied.
   2. Requirements of industrial education program appropriately satisfied.

D. Evaluation.
   1. Modification actually improved accessibility.
   2. Modification does not hinder others.
   3. Modification allows learner to perform identified task.
      All problems of accessibility have been appropriately eliminated.

CHAPTER 2

MODIFICATIONS TO CONSIDER WHEN IMPROVING THE INTERFACE

Making industrial education facilities accessible to students with physical disabilities is a task with two dimensions: psychological and physical. The task of making industrial education facilities psychologically accessible requires an effort by all teachers, "normal students," and the disabled student(s). The teacher must have or develop an accepting and constructive attitude toward students with physical handicaps. Next, there must be a willingness on the part of the teacher to use creativity and physical effort to make the necessary modifications to the facility.

The student's responsibility is to be realistic about the handicapping disability. A person's perception of their disability may be more disabling than the handicap itself. Some people disassociate themselves with the disability and try to compensate by driving themselves beyond their capabilities. When failure occurs, they frequently become frustrated, angry, and bitter.

Other individuals with disabilities overidentify with the able-bodied world. They hide their disabilities. As a result, they do not use the various aids that would reduce the effects of their disability. They sometimes limit their social contacts because they refuse to relate to other disabled persons.

Some identify too closely with other handicapped persons and cling to them for mutual support. This attitude separates the handicapped from the non-handicapped. If a teacher identifies and understands the attitudes that limit the functioning of a person, the teacher may prevent these attitudes from becoming a handicap. When the teacher encourages nonhandicapped students to work with the disabled student through the buddy system or grouping techniques, the disabled student will become more involved and accepted by the total group.

The second dimension of making industrial education facilities accessible is the physical dimension. A facility that is physically accessible is one where disabled students and nondisabled students can:

1. maneuver throughout the space.
2. approach, assume a proper working position, and use equipment, materials, and services.
3. obtain tools and supplies
4. transport tools and supplies.
5. manipulate controls on machines, tools, and space.
6. communicate by sending and receiving information.

Facility modifications are made to improve the learning environment and accessibility. Learning efficiency will thus be increased by providing more opportunities to become involved with manipulative activities. Efficiency in the performance of manipulative activities can be increased if the disabled person's energy and time are decreased. It should be noted that modifications that increase

the efficiency of disabled persons are often useful aids to the able-bodied individual as well.

Kinds of Modifications

Maneuvering in Space

In this monograph, *space* is defined to include all access areas, doors, and the instructional areas inside the industrial education laboratory. The focus is only on the space for which the industrial education teacher has primary responsibility, that is, the central industrial education laboratory and any auxiliary rooms used by students in performing instructional activities (e.g., finishing rooms, store rooms, darkrooms, recording studios, central meeting rooms).

Before students in a wheelchair, on crutches, with visual impairments, and so on can efficiently engage in instructional activities, they must be able to maneuver conveniently through the identified space. Common barriers to maneuverability include irregularities on the floor surface (this includes threshholds), damaged areas in the floor, grates, drop cords, waste materials, or tools. These irregularities pose direct problems for students in wheelchairs or those who have unsteady legs or poor balance.

Slippery surfaces are a great concern to students who use crutches, canes, or who have unsteady legs or poor balance. Narrow passageways with projections and sharp corners make movement virtually impossible and potentially dangerous for users of wheelchairs and walking aids.

Students in wheelchairs require that floor irregularities and slippery conditions be eliminated whenever possible and require extensive maneuvering room. Therefore, if standards for students in wheelchairs are observed, the requirements for other students — disabled or not — should be adequately met.

Many modifications to a facility will be simple and inexpensive; others will not. Cost depends on the existing conditions of the facility. Some basic standards and modifications suggestions follow.

Students in wheelchairs or on crutches require a minimum 3′0″ corridor width. A width of 4′0″ is needed when pedestrians may be encountered and 5′0″ if wheelchairs must pass each other. A 5″ turning diameter is needed if 180° turns are to be made. Entry doors should have a minimum clear opening of 2′8″ wide. These standards are often met by simply rearranging the furniture and machinery in the laboratory (see Figure 5).

Surface irregularities, such as cracks in the floors, threshholds, mats, grates, and waste materials, are hazardous to individuals in wheelchairs or those who use walking aids. Raised portions of a floor should not exceed ¼″ and should have no vertical surfaces. When two surfaces vary in height more than ¼″, a minimum of 1:12 pitch on the transition should be provided but 1:20 pitch is preferred.

Openings in floor grates and widths of cracks around their perimeter should not exceed ½″. Special care should be taken to keep waste materials, chips and dust, spilled liquids, extension cords and other similar items off the floor. Floor surfaces will be safer if textured or coated with nonskid materials. When both

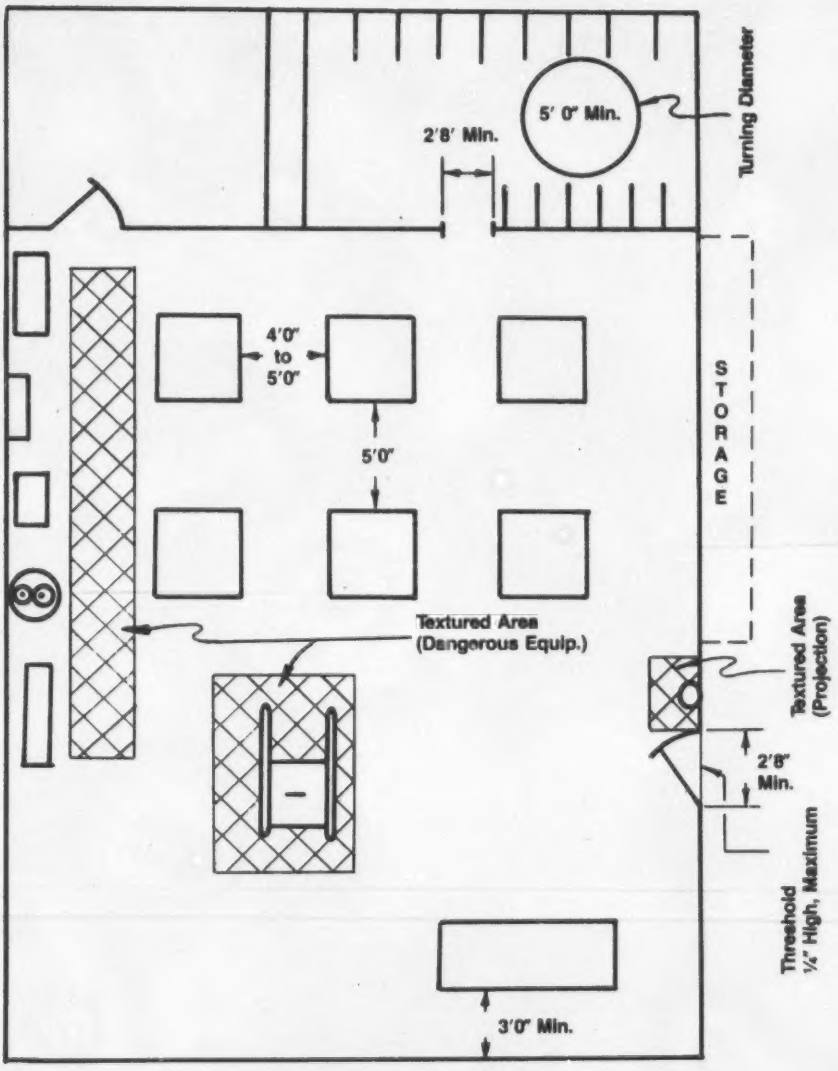


Figure 5 — Standards for Maneuvering Through a Facility

hands are required to complete a task, an apparatus for hanging or holding walking aids, tools and supplies are useful additions. Students with visual disabilities and who use the long-cane technique can maneuver through a facility more easily if textured strips are used as cues.

Doors that have timed opening and closing sequences can be activated by pressure switches. Devices of this type make it easy for students to move through doors with a minimum of effort and a maximum of safety. Mechanically operated doors should be equipped with clear plastic windows with the horizontal center line no higher than 4′6″ so that students may see others approaching. The closing time should not exceed 3 seconds. The delay before closing should be adjusted at 5 seconds or longer. Doors without opening and closing sequences should have closers with a maximum of 8 pounds of closing and opening pressures. Doors last longer if they are equipped with kick plates.

Whenever possible, handrails that are 1¼″ to 2″ in diameter should be provided along travel lanes. They should be placed 2′8″ to 2′10″ above the floor and 1½″ from the wall. Special care should be taken to remove, protect with padding, or provide cues and verbal warnings of all overhead obstructions.

Approaching Machines and Equipment

Once students can maneuver throughout the learning space, they are often confronted with a second set of barriers: they are unable to get close enough to the machines and equipment to operate them safely. Machine and equipment bases are often too low, too shallow or too narrow; work surfaces are too high or too low for task accessibility.

The standards for persons in wheelchairs are fairly well established: 2′3″ minimum vertical clearance, 1′8″ depth, 2′8″ width openings and 2′10″ maximum height working surfaces (see Figure 6). The standards for disabled students who use crtuches, canes, and walkers are more difficult to establish. In these cases, each situation has to be individually analyzed. Providing additional clearance under machines and other work surfaces (where feasible) will make your facility more accessible.

Location cues should be provided for blind people at all equipment locations, wall projections, and irregularities in the floor. These cues may take the form of audio buzzers, tones, or pulses and textured sections on the floor that can be detected with a cane.

When projections into a travel lane are unavoidable, they should be pointed out to students with visual impairments. Corners and ends of rods should be rounded and padded when necessary. If the projection is delicate instrumentation, it should be relocated or be covered with a protective device. In any case, the projection should not extend over 4″ into the travel lanes and should be extended to the floor or at the most, 8″ above the floor, so that it can be detected with a long cane.

There are additional modifications. Adjust the heights of work surfaces, such as drill presses and table tops. Provide lap boards that mount on wheelchairs or specially designed chairs so that equipment such as typewriters and table model photo tripods can be used. Design leaning boards that can be used to aid students with unsteady legs so that they can operate a machine or work at a counter top. Add support straps to furniture that can be used to hold a person up to a counter or equipment, making it possible for the person to operate machines like a metal lathe, shaper, mill, or drill press.

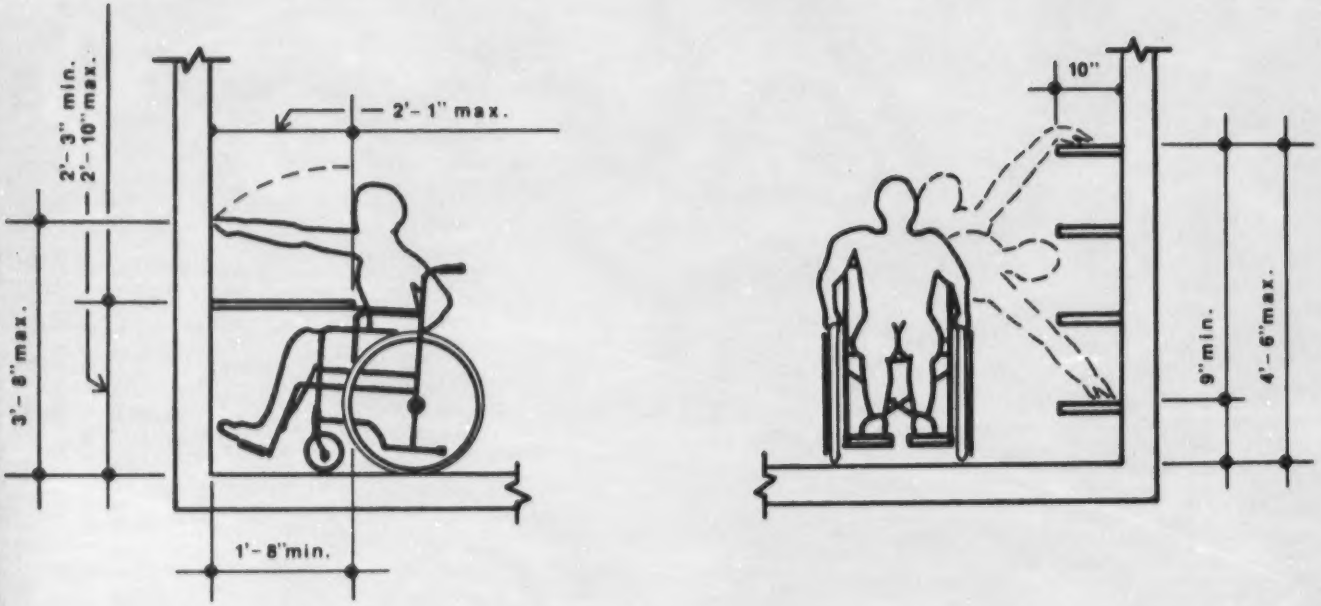


Figure 6 — Standards for Approaching Equipment and Furniture (U.S. Architectural and Transportation Barriers Compliance Board, 1981, p. 8, 69)

Students with weak or poor hand control can do many tasks that they would otherwise be unable to do by using electric scissors, electric knives, air- or electric-powered staplers, nailers, sanders, screwdrivers rather than the more common hand-powered models. All of these items are relatively inexpensive and are useful in the home as well as in an industrial setting.

Obtaining Tools and Supplies

Industrial education laboratories are noted for their variety of lockers, cabinets, bins, shelves, drawers, closets, and racks that are used to store and secure materials, tools, and projects. Storage equipment presents three kinds of barriers: gaining access, reaching items, and finding items.

When gaining access, students are often handicapped when padlocks, keys, small door handles, and hanging devices need to be manipulated with hands that lack strength and coordination. Once access is gained, students may still be frustrated because they cannot reach the items needed to complete a task. Shelves may be too high, too low, or too deep. Items may be inside easily opened cabinets and be within reach but are heavy or sharp. Many items are stored in a location where they may fall on an individual. Still other persons may have difficulty finding items because they are blind or are confined to a wheelchair and are unable to see what is on a shelf above their heads. Teachers should remember that students in wheelchairs usually cannot reach below 9″ from the floor, or above 4′6″ and horizontally more than 2′0″, depending upon the size of the person. Shelves at the maximum heights should not exceed 10″ in depth and at the 2′10″ height should not exceed 2′1″ in width (see Figure 7).

There are not many general standards for obtaining tools and supplies; however, several simple modifications will improve accessibility. Use a minimum of locks, avoid padlocks (especially combination padlocks) and use friction or magnetic catches rather than latches that require manipulation, small knobs, and so on.

Small knobs and recessed handles should be replaced with large handles that are easy to grasp with the entire hand or hook with prosthetic devices. Touch latches would help in extreme cases.

Obtaining equipment and supplies is made more convenient by placing them close to the area of usage. These items could be stored at locations in precut, preprocessed forms and in easily handled quantities or sizes. Thus, a disabled learner does not need to handle large, heavy, cumbersome pieces of materials or containers. Stacking items should be avoided. Pullout shelves and revolving shelves or bins are more convenient to use than the typical fixed shelves and bins.

Movable storage devices improve accessibility by allowing materials to be brought to the student rather than the student going to the materials. By organizing materials into meaningful arrangements or putting them into kits, students with visual handicaps will be better able to locate supplies and equipment. Labels on storage units and spaces that have at least ½″ letters, raised 1/32″, and in contrasting colors are easy to read by touch or by students with limited vision.

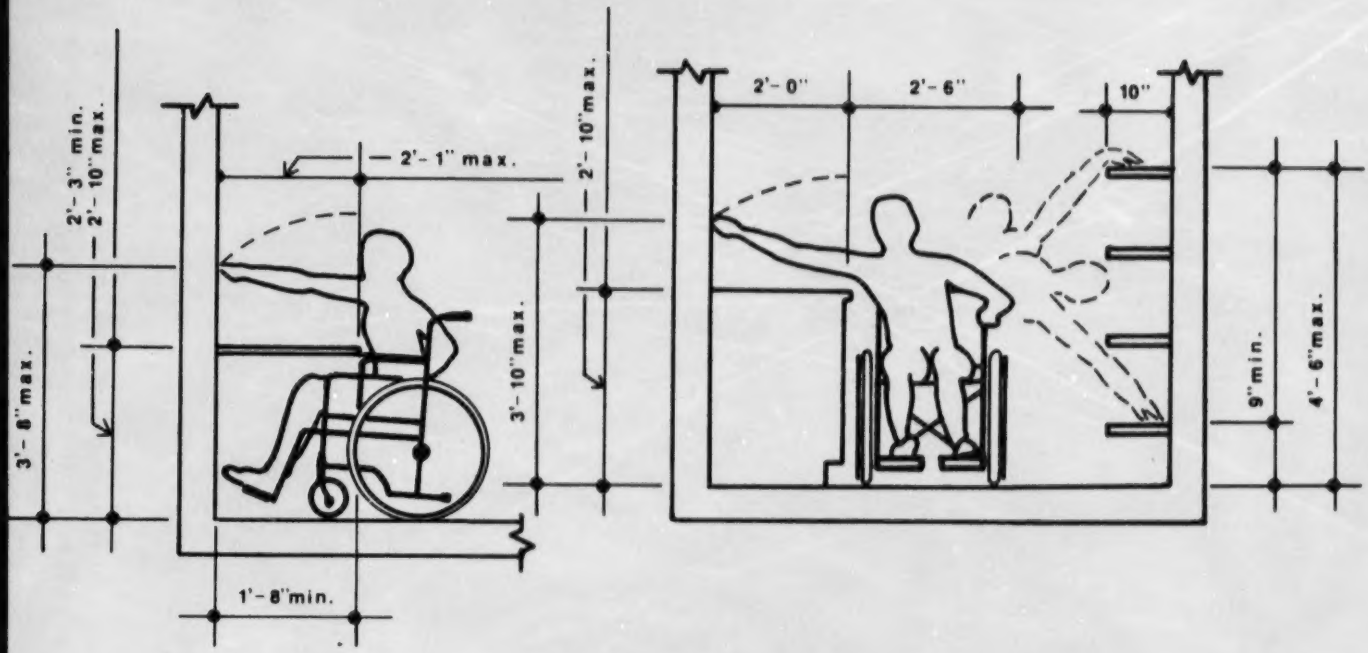


Figure 7 — Standards for Storage Units
(U.S. Architectural and Transportation Barriers Compliance Board, 1981, p. 8, 9, 69)

Transporting Tools and Supplies

Industrial education activities generally require the movement of materials, equipment, tools, and personal items. The transportation of tools and supplies can become a barrier to effective learning if a person has the added responsibility of maneuvering wheelchairs, has limited strength and control of their arms and hands, or has sight or hearing disabilities.

Fortunately, a few simply constructed modifications can contribute greatly to making learning activities more easily accomplished. A transfer board approximately 8" by 2'3" with tapered ends is very useful in sliding heavy items from a table surface to a utility tray on a wheelchair and back again. Cloth pouches or small boxes attached to walking aids or wheelchairs and shoulder bags are very useful in transporting a variety of small items from one location to another (see Figure 8). A variety of carts and dollies are available for purchase and special ones can be designed to transport heavy items.

Certain types of equipment — such as photographic copystands, entire collections of equipment (like videotape systems), an engine test stands — can be stored in cabinets equipped with large, easily maneuvered casters.

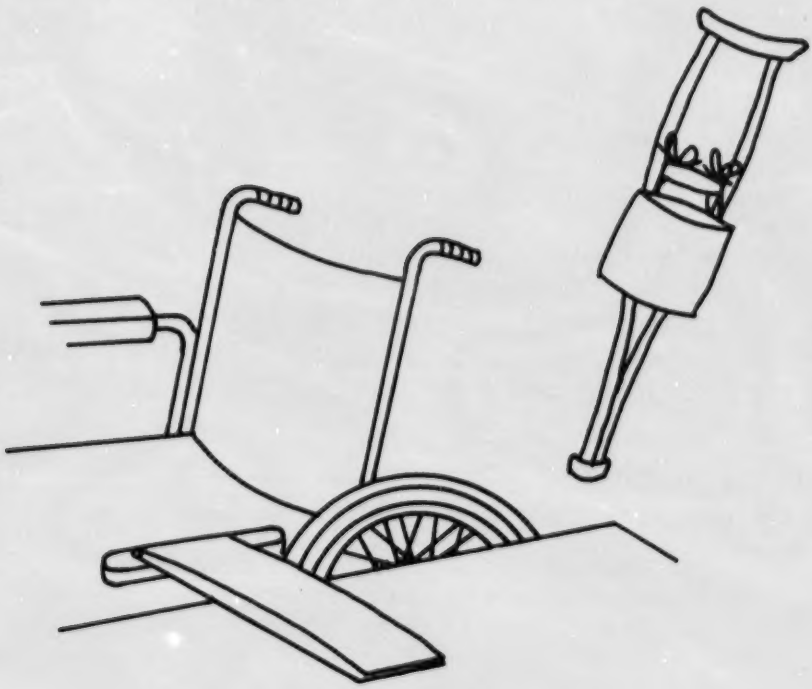


Figure 8 — Aids to Transporting Tools and Materials

Manipulating Controls

Controls are any device manipulated by the operator that turns a machine or device on or off, changes speed or feed, or changes the direction, angle, or depth of cut, or the performance of the equipment in any planned way.

Controls on standard machines and equipment are a source of barriers that limit the kinds and amount of learning and present serious safety hazards to many disabled students. Controls with keyed locks and small or hard to grasp knobs and placed in inconvenient locations are difficult to operate for students with limited finger dexterity, strength, and coordination. Not only are many switches and controls hard to actuate, but in use by visually impaired students, are also difficult to find.

Beyond a few recommendations about the placement of controls to be within easy reach of the learner, to be of minimum size and in contrasting colors, specific standards for controls are stated in the form of suggestions and guidelines. In general, the standards for controls are that switches and controls should be located in an easy to reach location that is between 2′11″ and 4′6″ from the floor. Buttons should be a minimum of ¾″ in diameter and should be raised rather than recessed. Touch buttons present a special problem for the visually impaired. If there are several buttons on the same panel, several wrong buttons may be touched before the right one is touched. Also, touch buttons do not provide actual feedback when they are actuated. Therefore, blind persons do not know if the task was completed.

Modifications can include enlarged push plates to replace the smaller shielded switches. The accessibility of conveniently located controls can be improved by adding extensions, such as push rods or pull chains. Hand-operated switches of all kinds can be replaced with foot-operated switches. Switches and controls can be made easier to see if they are enlarged and in contrasting colors.

Adjustment wheels and levers are easier to operate if they are enlarged or lengthened. When possible, replace controls that must be grasped and twisted (faucets) with levers.

Calibrations should be enlarged and printed with contrasting colors. Where this is not possible, using a magnifyng glass and an auxiliary light source can make calibrations more readable.

Facilitating Communication

When teachers work with students in teaching/learning situations, it is essential that the communication between student and teacher be as clear and as efficient as possible. Visual and hearing impairments can be handicaps to clear and efficient communication. These handicaps become barriers when students are unable to hear or see well enough to receive adequate information from the teacher or media during formal presentations, interviews, discussions, and briefing sessions. The problem is further complicated when students are unable to write or verbalize questions, projects, feedback on progress, or otherwise send messages.

Standards for communication devices include those for signage and labels of switch panels. Characters for signage should be 6" to 10" tall, with a width to length ratio of 3:5, a stroke width of 1", and raised 1/32" with sharp edges. Switch and elevator panels should have letters that are a minimum of 1/2" tall and raised 1/32." In both of the above cases the characters should be in a color that contrasts with the background. Where appropriate, standard international symbols should be used to reinforce or to replace word messages.

Modifications for students with only one impairment of a receiving sense, such as vision or hearing, are more easily made than when two or more receiving senses are impaired. Pictures and printed material can be used for the deaf or audio messages for the blind. Those who still have some of their vision or hearing may still receive visual or audio messages if extra illumination and/or magnification or amplification, respectively, are provided.

Students who are unable to write may be assisted by typewriters with strikeover correction tape cartridges. A slanted armrest in front of the typewriter helps to support weak arms. Those who can write and draw are helped with pencils or felt markers that have enlarged barrels. Slanted work surfaces, large pads of paper, magnetic paper holders and drawing instruments, and electric pencil sharpeners are valuable aids.

If students have not learned to write or type but can speak, audio cassette recorders make it possible for the students to demonstrate their knowledge of a subject by dictating a report.

An able-bodied person can make a carbon copy of the notes and share them with a disabled student who cannot write fast enough to keep up. In this manner, the disabled student has notes to study from and the class routine is not interrupted.

A teacher can facilitate communication with hearing impaired students by:

1. facing the student when speaking.
2. speaking clearly with normal speed and enunciation.
3. standing still while speaking.
4. avoiding bright backgrounds, such as windows.
5. using expressive body language.
6. maintaining eye contact with student.
7. using visuals and chalkboard.
8. providing outlines, vocabulary lists, and response forms.
9. seating disabled person in full sight of group members.
10. repeating questions and statements from students in the back of the room.
11. placing an interpreter close to disabled learners and yourself.
12. pausing to allow for translation.

Students with visual impairments can receive more information if the teacher:

1. speaks in a normal voice.
2. describes handouts.
3. speaks directly to the student.

4. uses sense of touch as a substitute for sight.
5. uses complete explanations of what things look like and of what is being done.
6. identifies distinguishing tactile features.
7. seats person where hearing and touching objects are easy.
8. tours the learning area and explains and describes the appearance and location of objects and features of the area.

Backup alarm systems should be installed in industrial education laboratories so that a hearing impaired person can see flashing lights and blind persons can hear the alarm system.

SUMMARY

The modifications making a facility accessible to students with physical handicaps is a task that can be achieved in your facility. The starting point is to develop a positive and constructive attitude toward understanding the learners' disabilities and strengths, then making the required modifications to fit the students' needs. The first step is probably just rearranging machines, furniture, or storage areas to improve traffic flow.

The greatest challenge and effort will be in developing a positive communication linkage system between you and your disabled students. This positive attitude and atmosphere must be further extended to all members of the class and to the administrative body that must support your modification plan. An example of improving communications in the classroom would be using a "buddy" system from peer groups to assist the disabled student. Note than none of the aforementioned suggestions cost any money. The only expense is the physical energy required to rearrange equipment or furniture and the mental energy to modify and understand the capabilities of the handicapped student in your classroom.

The uniqueness of this total problem is that you will not have to make all of the modifications discussed in this monograph at once. You will probably only have one or two disabled students; therefore, you will only need to make changes for their impairments. These modifications will remain and can be used with future students with similar disabilities that use your laboratory. In many circumstances, the changes made will improve accessibility to all students, therefore improving the total learning environment in your laboratory.

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FEDERAL AGENCIES AND OTHER ORGANIZATIONS

FEDERAL AGENCIES

Architectural and Transportation Barriers Compliance Board
330 C. Street, S.W.
Washington, D.C. 20202

Office of Handicapped Individuals
Humphrey Building
200 Independence Ave., S.W.
Washington, D.C. 20201

President's Committee on Employment of the Handicapped
Washington, D.C. 20202

White House Conference on Handicapped Individuals
1832 M Street, N.W.
Washington, D.C. 20036

OTHER ORGANIZATIONS:

National Center for a Barrier-Free Environment
8401 Connecticut Ave.
Washington, D.C. 20015

Local Chapters of the United Cerebral Palsy Association, Easter Seals Society, or other organizations of and for disabled persons in your locality.

State Department of Vocational Rehabilitation (located in your state capitol)